

## **Effect of atmospheric organics on bioavailable Fe lifetime in the oceans**

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The deposition of atmospheric aerosols is an important supply pathway of soluble iron (sol-Fe) to the global oceans influencing marine ecosystem processes and climate. Previous studies have shown that natural and anthropogenic acidic trace gases, when mixed with mineral dust, can lead to production of sol-Fe, leading to considerable increase in dust-Fe solubility. Recent studies have further highlighted the importance of atmospheric organic compounds/ligands in the production of sol-Fe during atmospheric transport and transformation of mineral aerosols. However, the actual scope of this aerosol sol-Fe for stimulating the primary productivity in the oceans is determined by both: the total atmospheric fluxes of sol-Fe and the lifetime of sol-Fe after its deposition to the ocean. In this study several atmospheric organic ligands were investigated for their effect on the lifetime of sol-Fe after mixing with seawater. Organic ligands were selected based on their abundance in the marine boundary layer and rainwater and their ability to form bidentate complexes with Fe. The results reveal that the tested organics had minor influence on Fe(II) lifetime in seawater. However, results also show that some organic acid considerably extended the lifetime of colloidal and aqueous Fe(III). Using these results we simulate aerosol sol-Fe lifetime in the ocean for different mineral dust deposition events in the presence and the absence of atmospheric organic ligands. The calculations suggest that when a large dust plume is assumed to contain Fe(II) alone, less than 15% of aerosol sol-Fe gets complexed with marine organic ligands. However, this fraction increases to over 90% when atmospheric Fe is allowed to bond with atmospheric organic acids prior to deposition to the oceans. Calculations also show that for the conditions when seawater organic ligands get titrated by Fe released from dust aerosol particles, retention of sol-Fe in the ocean depends on surface ocean mixing, i.e., replenishing rates for Fe-bonding ligands from below. This study suggests that in future ocean biogeochemistry models more attention should be devoted to better quantification of the role of atmospheric organic acids in the lifetime of aerosol sol-Fe after its deposition to the ocean and the improvements of upper ocean turbulence parameterizations.